is partly addressed, and render it unsuitable for continuous reading except to those already well versed in organic chemistry. But to those who desire to find the latest authoritative information of a chemical kind it will prove an excellent work of reference.

W. D. H.

Geometry, Theoretical and Practical. Part iii. By W. P. Workman and A. G. Cracknell. Pp. ix+66. (London: W. B. Clive, 1908.) Price 1*s.* 6*d.*

THIS part of Messrs. Workman and Cracknell's text-book deals with the subject-matter of Euclid, book xi., on modern lines, and contains also an elementary account of the parallelepiped, sphere, and tetrahedron. The characteristics of previous parts are well maintained; the brevity of treatment and the conciseness of arrangement will appeal specially to examination candidates.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

The γ Rays of Uranium.

OUR knowledge of the γ rays of uranium has until now been confined to their discovery by Rutherford (*Phys. Zeit.*, 1902, 517) and to the observations of Eve (*ibid.*, 1907, 185). The latter directed attention to their extraordinary feebleness and to their relatively low penetrating power. Eve found that uranium gives out only about one-tenth as much γ radiation as thorium when examined through 0·64 cm. lead, which is most remarkable, considering that it gives about six times more β radiation. Whereas the γ rays of thorium have the same value for the absorption coefficient as those of radium [$\lambda(\text{cm.})^{-1}=$ from 0·57 to 0·46 over a range of from 0·64 cm. to 3·0 cm. of lead], the uranium γ rays are far more easily absorbed. Eve gave the value 1·4 for λ for thicknesses of lead between 0·28 cm. and 0·92 cm. He stated that the radiation was homogeneous, that the absorption was exponential over this range, and that the rays were practically completely absorbed in 1 cm. of lead. He worked with uranyl nitrate.

Having at our disposal 50 kilograms of pure uranyl nitrate, provided by the generosity of a friend in connection with the work of one of us on the parent of radium (NATURE, January 28, 366), we have been able greatly to extend and in part to correct the work on the uranium γ rays. By a long sequence of chemical operations, known and new, but based largely on the magnificent chemical work of Sir William Crookes, who discovered the substance (Proc. Roy. Soc., 1900, lxvi., 409), we separated by far the greater part of the uranium X from the uranium, and obtained it, in the last separation, in the form of films weighing only a few milligrams. The operations absorb about twelve days. Uranium X contributes, as first shown by one of us (Trans. Chem. Soc., 1902, 860), none of the α rays, but all the β rays of the uranium, and, as is to be expected, and as the present work shows, the γ rays also. These have been found to decay at the same rate as the β radiation, namely, to one-half every twenty-two days. The initial β radiation of the bare preparation lit up an X-ray screen to about the same extent as 7 mg. of pure radium bromide contained in a sealed thin glass tube. The luminosity could be plainly seen in a fully lighted room when the screen was held in the shadow of the observer; but as Eve found, the γ radiation is extraordinarily feeble. It was accurately compared with that from a known quantity of pure radium bromide after passage through 2·5 cm. of lead by means of an electroscope. Under these conditions the uranium X was equivalent to 0·053 mg. of radium bromide. As shown later, it can be calculated that the lead screen cut down the γ rays of the uranium X to 20·6 per cent., and of the radium to 55 per cent., of their initial values. From these data, allowing for the decay during the processes of separation, it may be provisionally estimated that the radiation of the two elements, uranium and radium, is about as one to five hundred million when, as in the present case, absorption is eliminated and only the hard γ rays dealt with.

Before the activity of the preparation decayed too far we were able to determine accurately the absorption coefficient of the γ rays in fourteen substances. As Wigger found for the γ rays of radium (*Jahrb. Radioakt.*, 1905, 430), the absorption follows a strict exponential law after a certain initial thickness of substance has been penetrated, and the absorption coefficient is very nearly proportional to the density of the substance. Thus for lead between the thicknesses of 1 cm. and 5 cm.—and for all other substances over corresponding thicknesses—the absorption is within the very small limit of experimental error absolutely exponential. The value of the absorption coefficient, $\lambda(\text{cm.})^{-1}$, for lead is 0·62. In general, for all substances the value of λ/d, where d is the density, is about 0·055, as compared with 0·021 for the radium γ rays for thicknesses greater than 2·8 cm. of lead (Wigger). Thus the uranium γ rays are about two and a half times more strongly absorbed than those of radium.

The conditions of the experiment are of fundamental importance, as they affect very much the value obtained for the absorption coefficient. In our experiments the disposition was in the main similar to that of Wigger, in that the absorbing plates were clamped up tightly to form the base of the electroscope, and the preparation was placed in a definite position beneath. For insulators the upper surface was covered with a thin leaf of aluminium. Whenever practicable, the absorbing plates were all of the same material. Only for light substances, and for one experiment with mercury, was the base of the electroscope a plate of lead as in Wigger's experiments. Its thickness was 1·2 cm.

Our value for the absorption coefficient is entirely different from that given by Eve, and, indeed, it is a little doubtful what rays Eve observed. Over the range of thickness of lead he used, from 0·28 cm. to 0·92 cm., we find that the rays are not homogeneous, and the exponential law does not hold at all. There is present in relatively great intensity a *very* much less penetrating radiation, completely absorbed by 1 cm. of lead, with a value for λ from eight to ten times greater than for the penetrating type. The absorption and magnetic deviability of these rays are under examination. They would have been far less prominent relatively in Eve's measurements with uranyl nitrate than in ours with uranium X, owing to the strong absorption in the former case. It may be mentioned that the existence is to be anticipated of a very soft γ radiation corresponding to the extremely soft β radiation of uranium X (Schlundt and Moore, Levin, H. W. Schmidt). There appears to be no radiation corresponding with Eve's value of λ, but then his value for the γ rays of radium, 0·46, is about as different from Wigger's, 0·24, as his value for the uranium γ rays, 1·4, is from ours, 0·62.

The value found in our experiments for λ/d, 0·055, was actually obtained exactly for substances so different in density and nature as mercury, lead, aluminium, slate, and pine-wood, showing the remarkable range of the "density law" in this case. At the same time, we do not think it holds strictly, for brass (density 8·40) actually absorbed more than copper (8·80), and zinc (7·07) more than tin (7·25), in experiments which were strictly comparable and under good conditions. The actual experimental values of λ/d obtained varied within the extremes of 0·045 (one value for iron) and 0·068 (paraffin wax). Part of this variation, but not, we think, the whole, is doubtless due to experimental error. Although the exponential law holds, so far as we can see, quite strictly, the values obtained for λ appear to depend somewhat on the particular experiment in an as yet not completely explained way. We propose carrying out similar experiments with the γ rays of radium, in the hope of obtaining further light on the nature of the variation.

Beyond 5 cm. of lead, and corresponding thicknesses of other metals, λ appears to change and to become very

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much smaller, indicating the existence of a still more penetrating type of radiation than the γ, but our preparations are hardly sufficiently active to enable us to establish this beyond doubt. Here again the experiments we propose with the radium γ rays may throw more light on the matter.

FREDERICK SODDY.
ALEXANDER S. RUSSELL.
Physical Chemistry Laboratory, University of Glasgow, February 27.

The Radio-active Deposits from Actinium.

IN NATURE of February 25 there appeared a letter from Prof. McLennan containing the results of some experiments recently made by Mr. W. T. Kennedy on the behaviour of the active deposit from actinium emanation.

So far as may be judged from the details given of the observations, they substantially confirm the results obtained by the writer, which are to be found in the *Phil. Mag.*, May and June, 1908.

The suggestion that the differences in the quantity of active deposit observed on the positive and negative electrodes can be explained by the different rates of diffusion of the ions is an interesting one, but it seems likely that the determining factor is the frequency of collision between the active deposit particles and the gas molecules or ions with which they are mixed.

It is impossible to make a complete comparison between the experiments of Mr. Kennedy and myself until further data are available. S. RUSS.

Physical Laboratories, Manchester University.

The Production of Prolonged Apnœa in Man.

NOTICING the letter by Dr. H. M. Vernon in NATURE of February 18 on "The Production of Prolonged Apnœa in Man" it recalled to my mind some observations on the same subject communicated to the *Philosophical Magazine* in 1833, vol. iii., p. 241, by Michael Faraday, and reprinted in his collected "Researches in Chemistry and Physics," pp. 358–62.

The effect of a bout of forced breathing in enabling a person greatly to prolong the time during which they can hold their breath was brought under the notice of Faraday by Sir Graves C. Haughton.

Faraday was ever one who put things to a practical use, and he gives directions as to the mode of proceeding when one had to enter a noxious atmosphere to rescue a person overcome by the fumes of a poisonous gas. He says:—"Avoid all unnecessary action; for activity exhausts the air in the lungs of its vital principle more quickly, and charges it with bad matter. Go collectedly, coolly, and quietly to the spot where help is required: do no more than is needful, leaving what can be done by those who are in a safe atmosphere (as the hauling up of a senseless body, for example) for them to do.

"Take the precautions usual in cases of danger in addition to the one now recommended [namely, by preparing the lungs by several deep breaths]. Thus, in a case of choke-damp, as in a brewer's vat, hold the head as high as may be; in a case of fire in a room, keep it as low down as possible."

He concludes his communication with a remark on the effect of increasing the pressure of the air breathed by giving the case in which Mr. Brunel, jun., descended in a diving-bell to a depth of 30 feet below the surface of the water, when it was found that both he and his companion could remain under water (by descending from the bell itself) for about twice as long as they could had the air they breathed only been under normal pressure. It would be interesting to know how long the breath could have been held in the above case had Mr. Brunel employed forced breathing, supplemented by three or four breaths of pure oxygen. If the relation of pressure and time during which the breath could be retained held good for the time of 8m. 13s. given by Mr. Vernon, this period should be increased to 16m. 26s. when air under two atmospheres (absolute) pressure was breathed, aided by about four breaths of oxygen. W. G. ROYAL-DAWSON.

40 Creffield Road, Ealing, February 23.

A Winter Retreat.

MR. GEORGE GILBERT, a market-gardener in Stonehaven, has shown me a curious phenomenon which I have not met with before, and which, I think, deserves to be recorded. About the beginning of November a number of children were playing at a tea-party, and they left among the herbaceous plants at the side of the walk an earthenware tea-pot, the dimensions of which were 4 inches by 3 inches. A few days ago the old tea-pot was discovered lying on its side and without a lid. In the interior, closely packed, were no fewer than thirty-seven of the common garden shelled-snail, and when ejected they were found to be all alive. They had spent the months in their winter retreat. Probably gardeners know that they can trap snails in some such way; at all events, one often finds snails in confined spaces and sheltered nooks. Still, the question arises, What led one mollusc to follow the others? Is it the sense of smell? What attracted no fewer than thirty-seven to this old tea-pot, probably a very snug and safe place? Still, there is a danger in being in a crowd. One can imagine how delighted a sea-gull would have been to have discovered this larder of fresh meat!

JOHN G. MCKENDRICK.

Priestley and Coulomb's Law.

IN our text-books on electricity I do not remember to have seen Priestley's name associated with the proof of Coulomb's law as derived from the fact that no electrification can be obtained in the interior of a sphere charged with electricity.

In the article "Priestley" in the "Dictionary of National Biography" it is stated that Priestley anticipated Coulomb's law, and in looking into the matter I find foundation for the statement in the following paragraph from "The History and Present State of Electricity with Original Experiments," by Joseph Priestley, second edition, 1769, p. 711:—

"May we not infer from this experiment" (absence of electrification within an electrified cup) "that the attraction of electricity is subject to the same laws with that of gravitation and is therefore according to the squares of the distances; since it is easily demonstrated that were the earth in the form of a shell a body in the inside of it would not be attracted to one side of it more than another." C. J. WOODWARD.

Birmingham, February 26.

Barometric Oscillation.

IN my remark referred to by Mr. Braak (February 18, p. 459) I merely meant the increase of temperature which inevitably occurs when a gas is compressed. The compression and warming are simultaneous; this is shown in the passage of a sound wave where the air is compressed and warmed, and expanded and cooled alternately many hundreds of times in a second. If a barometric change is followed by a change of temperature at some subsequent time the result must be due to other conditions than those to which I alluded. W. H. DINES.

Life and Letters of Prof. A. Newton, F.R.S.

I HAVE been invited to write a life of the late Prof. Alfred Newton, F.R.S., of Magdalene College, Cambridge. If any of your readers who have letters or reminiscences or other interesting information about Prof. Newton will be kind enough to communicate with me, I shall be exceedingly grateful to them. I will, of course, undertake to return all letters, &c., to the senders.

A. F. R. WOLLASTON.

Savile Club, 107 Piccadilly, W., March 1.

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